

Message Text

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TO USMISSION GENEVA PRIORITY

INFO AMEMBASSY BONN

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AMEMBASSY MOSCOW

AMEMBASSY OTTAWA

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SUBJECT: CCD-ENMOD EXPERTS MEETING - RESPONSE TO GDR
QUESTIONS

DISTO

REF: GENEVA 6159

1. FOLLOWING INFORMATION IS PROVIDED IN RESPONSE TO
REQUEST REFTEL.

2. LIKELIHOOD AND MAGNITUDE OF EARTHQUAKES FOLLOWING UNDER-
GROUND NUCLEAR EXPLOSIONS. (SOURCE: ENVIRONMENTAL IMPACT
STATEMENT, PROJECT CANNIKIN, APRIL 1971, US ATOMIC ENERGY
COMMISSION)

(A) THE SUGGESTION HAS BEEN MADE THAT GROUND MOTION AND
STRAIN EFFECTS RESULTING FROM A NUCLEAR EXPLOSION MIGHT
TRIGGER AN EARTHQUAKE, PRODUCING GROUND MOTION MUCH STRONGER
THAN THAT FROM THE EXPLOSION ITSELF. UNLIKE THE MORE DIRECT
EXPLOSIVE EFFECTS, THE PROCESS BY WHICH SUCH AN EARTHQUAKE
MIGHT BE TRIGGERED IS NOT YET SUBJECT TO EXACT ANALYSIS
AND CALCULATION.

(B) IN CONNECTION WITH PROJECT CANNIKIN, A PANEL OF
EMINENT SCIENTISTS AND ENGINEERS, ACTING AS CONSULTANTS
TO THE US ATOMIC ENERGY COMMISSION, EXAMINED THIS QUESTION
WITH EXTREME CARE. THEIR COMMENTS ARE DIRECTLY PERTINENT:
QUOTE

" ALTHOUGH A GENERAL THEORY OF THE MECHANISM BY WHICH AN
UNDERGROUND EXPLOSION CAUSES EARTHQUAKES TO OCCUR HAS NOT
BEEN DEVELOPED, THE EXPERIENCE GAINED IN NTS (NEVADA TEST
SITE), CNTS (CENTRAL NEVADA TEST SITE), AND STS (SUPPLE-
MENTAL TEST SITE) SUPPORTS THE CONCLUSION THAT AN EXPLO-
SION WILL NOT TRIGGER A LARGE EARTHQUAKE (DEFINED AS ONE
RELEASING AS MUCH OR MORE SEISMIC ENERGY THAN THE EXPLO-
SION ITSELF) UNLESS THE EVENT IS DETONATED NEAR A FAULT
ON WHICH AN EARTHQUAKE OF THIS MAGNITUDE IS IMMINENT."
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(C) MOST U.S. EXPERIENCE IN THIS AREA IS FROM LARGE
UNDERGROUND EXPLOSIONS IN NEVADA. MANY AFTERSHOCKS HAVE
BEEN OBSERVED THERE FROM THE LARGEST TESTS, BUT THESE
VIRTUALLY ALWAYS OCCUR FAIRLY CLOSE TO THE EXPLOSION SITE
-- WITHIN A RANGE OF LESS THAN 10 MILES FOR CLEARLY TEST-
RELATED EVENTS -- ALTHOUGH THERE IS A SUGGESTION THAT
SOME SMALL QUAKE WERE TRIGGERED OUT TO ABOUT 25 MILES
FROM THE SITE OF ONE TEST. BY AND LARGE, THESE SMALL

QUAKES -- ALWAYS OBSERVED TO BE MUCH LOWER IN ENERGY RELEASE THAN THE NUCLEAR EXPLOSIVE WHICH TRIGGERS THEM -- CAN REASONABLY BE SAID TO HAVE BEEN GENERATED BY THE EXPLOSION, SINCE THEY WOULD NOT HAVE BEEN EXPECTED TO OCCUR NATURALLY. THIS TYPE OF EVENT DIFFERS FROM THE PREMATURE TRIGGERING OF A LARGE NATURAL EARTHQUAKE (HAVING MORE SEISMIC ENERGY THAN THE EXPLOSION ITSELF), WHICH HAS NEVER BEEN OBSERVED FROM A U.S. NUCLEAR TEST.

(D) IN ADDITION TO THE ABOVE INFORMATION THE FOLLOWING HAS BEEN ABSTRACTED FROM AN UNCLASSIFIED RECENT STUDY "EXPLOSION INDUCED GROUND MOTION, TIDAL AND TECTONIC FORCES AND THEIR RELATIONSHIP TO NATURAL SEISMICITY":

THIS REPORT WAS AN INVESTIGATION REVIEW AND SYNTHESIS OF THE NATURAL AND MAN-MADE FORCES WHICH INFLUENCE THE SEISMICITY OF THE NTS AREA AND THE ADJOINING REGIONS. A COMPREHENSIVE DATA FILE WAS COMPILED FOR EARTHQUAKES IN THE WESTERN US WITH ANALYSIS OF OVER 30,000 EARTHQUAKES IN THIS REGION FROM 1852 THROUGH 1973. THE RESULTS OF THESE STUDIES SHOW THAT THE UNDERGROUND NUCLEAR TESTING PROGRAM DID NOT PRODUCE ANY DETECTIBLE INFLUENCE ON THE NATURAL PATTERN OF EARTHQUAKE ACTIVITY EXCEPT IN THE IMMEDIATE AREA OF THE SHOT.

3. STIMULATION OF EARTHQUAKES BY INJECTING FLUIDS INTO FAULT ZONES. (SOURCE: DR. C.B. RALEIGH, NATIONAL CENTER FOR EARTHQUAKE RESEARCH, U.S. GEOLOGICAL SURVEY, MENLO PARK, CALIFORNIA)

(A) GENERALLY SPEAKING, EARTHQUAKES RESULT WHEN THE STRAIN ENERGY WHICH HAS BUILT UP IN A FAULT ZONE IS SUDDENLY RELEASED. THERE IS NOW SUBSTANTIAL EVIDENCE UNCLASSIFIED

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THAT INJECTION OF LARGE QUANTITIES OF FLUID UNDER HIGH PRESSURE CAN REDUCE THE FRICTIONAL RESISTANCE TO SLIPPAGE ALONG THE FAULT ZONE, THUS RESULTING IN EARTHQUAKES.

(B) SWARMS OF EARTHQUAKES HAVE BEEN OBSERVED WITH FLUID INJECTION CARRIED OUT FOR DISPOSAL OF TOXIC WASTES (DENVER, COLORADO) AND FOR SECONDARY RECOVERY OF PETROLEUM (RANGELY, COLORADO). THEY HAVE ALSO BEEN OBSERVED AFTER CREATION OF LARGE SURFACE RESERVOIRS. IN ABOUT 15 CASES, CONSTRUCTION OF RESERVOIRS HAS TRIGGERED EARTHQUAKES. THE MOSTSEVERE HAVE HAD A MAGNITUDE OF 6.0 - 6.5 ON THE RICHTER SCALE. THE MECHANISM INVOLVED APPEARS TO BE THE SAME AS IN THE CASE OF FLUID INJECTION.

(C) WHILE THERE HAS BEEN SOME DISCUSSION OF POSSIBLE

FUTURE TECHNIQUES DESIGNED TO RELEASE STRAIN ENERGY PERIODICALLY TO PREVENT OCCURRENCE OF LARGE EARTHQUAKES, NO KNOWN ATTEMPT HAS YET BEEN MADE TO MODIFY SEISMIC ACTIVITY DELIBERATELY BY INJECTING FLUID INTO AN ACTIVE FAULT REGION.

(D) FROM A PURELY THEORETICAL STANDPOINT, UNDER EXTREME CONDITIONS IT MIGHT BE POSSIBLE TO CAUSE A LARGE EARTHQUAKE FOR HOSTILE PURPOSES; THIS HOWEVER SEEMS HIGHLY IMPROBABLE SINCE IT WOULD REQUIRE A SUBSTANTIAL LEVEL OF READILY IDENTIFIABLE DRILLING ACTIVITY AND INJECTION OF HUNDREDS OF MILLIONS OF GALLONS OF FLUID. IN ANY EVENT, IT WOULD NOT BE POSSIBLE TO CAUSE AN EARTHQUAKE IN AN AREA REMOTE FROM THE INJECTION SITE. KISSINGER

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